

What is claimed is:

1 1. An objective lens for different optical recording media which, for a selected first optical  
2 recording medium, focuses at a first numerical aperture an incident light beam having a first  
3 wavelength onto a desired position of the first optical recording medium and, for a selected  
4 second optical recording medium, focuses at a second numerical aperture that is smaller than the  
5 first numerical aperture, an incident light beam having a second wavelength onto a desired  
6 position of the second optical recording medium, said objective lens comprising:

7 at least one surface that is at least partially defined using an equation for an aspheric  
8 surface wherein the surface height in the direction of the optical axis becomes discontinuous at a  
9 boundary line corresponding to the outer boundary of incident light of the second wavelength  
10 that is focused at the second numerical aperture onto a specified position of the second optical  
11 recording medium;

12 at least one surface that is at least partially a diffraction optical surface that is defined  
13 using one phase difference function, said diffraction optical surface constructed so that

14 (a) the light flux of the first wavelength passing through a region of the diffraction optical  
15 surface corresponding to the first numerical aperture is focused onto a specified position of the  
16 first optical recording medium by the refractive power of the objective lens and the light  
17 diffraction effect of the diffraction optical surface,

18 (b) the light flux of the second wavelength passing through the region of the diffraction  
19 optical surface that is outside the region that corresponds to the second numerical aperture is not  
20 focused onto the specified position of the second optical recording medium by the refractive  
21 power of the objective lens and the light diffraction effect of the diffraction optical surface, and

22 (c) the light flux of the second wavelength passing through the region of the diffraction  
23 optical surface corresponding to the second numerical aperture is focused onto the specified  
24 position of the second recording medium by the refractive power of the objective lens and the  
25 light diffraction effect of the diffraction optical surface.

1 2. The objective lens for different optical recording media according to claim 1, wherein:

2 the diffraction optical surface and the aspheric surface are jointly formed so as to be

3 superimposed on the same surface; and

4 the phase difference defined by the one phase difference function of the diffraction optical  
5 surface is an integer multiple of  $2 \cdot \pi$  where the aspheric surface becomes discontinuous on this  
6 same surface.

1 3. The objective lens for different optical recording media according to claim 1, wherein the  
2 second optical recording medium has a substrate that is thicker than that of the first optical  
3 recording medium, and the first wavelength is shorter than the second wavelength.

1 4. The objective lens for different optical recording media according to claim 2, wherein the  
2 second optical recording medium has a substrate that is thicker than that of the first optical  
3 recording medium, and the first wavelength is shorter than the second wavelength.

1 5. The objective lens for different optical recording media according to claim 1, wherein the  
2 objective lens is made of plastic.

1 6. The objective lens for different optical recording media according to claim 2, wherein the  
2 objective lens is made of plastic.

1 7. The objective lens for different optical recording media according to claim 3, wherein the  
2 objective lens is made of plastic.

1 8. The objective lens for different optical recording media according to claim 4, wherein the  
2 objective lens is made of plastic.

1 9. The objective lens for different optical recording media according to claim 2, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 10. The objective lens for different optical recording media according to claim 3, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 11. The objective lens for different optical recording media according to claim 4, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 12. The objective lens for different optical recording media according to claim 5, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 13. The objective lens for different optical recording media according to claim 6, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 14. The objective lens for different optical recording media according to claim 7, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 15. The objective lens for different optical recording media according to claim 8, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 16. The objective lens for different optical recording media according to claim 1, wherein the  
2 numerical aperture NA at the position where the aspheric surface becomes discontinuous is set to  
3 a value in the range  $0.45 \leq NA \leq 0.52$ .

1 17. An optical pickup device that includes the objective lens for different optical recording

2 media according to claim 2.

1 18. An optical pickup device that includes the objective lens for different optical recording  
2 media according to claim 3.

1 19. An optical pickup device that includes the objective lens for different optical recording  
2 media according to claim 4.

1 20. An optical pickup device that includes the objective lens for different optical recording  
2 media according to claim 1.